

**WHAT IS CLAIMED IS:**

1. An apparatus for reducing a biological wasted sludge, said apparatus comprising:

a hydrolysis reactor for hydrolyzing the biological wasted sludge  
5 to become a hydrolyzed sludge;

a neutralization reactor for neutralizing the hydrolyzed sludge to result in production of an intermediate feed; and

a membrane bioreactor for effecting a biological decomposition of the intermediate feed;

10 wherein said membrane bioreactor comprises a filtration module having a permeate side and a contact side in contact with the intermediate feed, wherein liquid contained in the intermediate feed is in fluid communication with the permeate only through the filtration module; and a negative pressure source to enable the liquid to flow out of said  
15 membrane reactor via said permeate side as an effluent.

2. The apparatus as defined in claim 1, wherein said membrane bioreactor is further provided with an aeration device serving to provide the intermediate feed with an external gas.

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3. The apparatus as defined in claim 1, wherein said aeration device comprises an aeration pipe and a blower connected with said aeration pipe whereby said blower is used to force the external gas into said membrane bioreactor via said aeration pipe.

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4. The apparatus as defined in claim 3 further comprising a backwash pipe in communication with said blower and said permeate side of said filtration module.

5                5. The apparatus as defined in claim 1, wherein said filtration module is of a tubular or cassette construction and is made of a porous material.

6. The apparatus as defined in claim 5, wherein said porous  
10 material is a nonwoven material.

7. The apparatus as defined in claim 1, wherein said filtration module has a flux greater than  $0.05 \text{ m}^3/\text{m}^2 \cdot \text{day}$ .

15                8. The apparatus as defined in claim 1, wherein said intermediate feed contained in said membrane bioreactor is provided with aerobic, anoxic, or anaerobic microorganisms.

9. The apparatus as defined in claim 8, wherein the external gas  
20 is air or pure oxygen when the intermediate feed is provided with the aerobic microorganism; wherein the external gas is nitrogen or carbon dioxide when the intermediate feed is provided with the anoxic microorganisms; wherein the external gas is nitrogen, methane or marsh gas when the intermediate feed is provided with the anaerobic  
25 microorganisms.

10. The apparatus as defined in claim 1, wherein said hydrolysis reactor is provided with an agitator for stirring the biological wasted sludge, and a pH controller for regulating pH value of the hydrolyzed sludge.

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11. The apparatus as defined in claim 10, wherein the pH controller is used to regulate the pH value of the hydrolyzed sludge such that the pH value is greater than 9 or smaller than 3.

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12. The apparatus as defined in claim 1, wherein said hydrolysis reactor is provided with an agitator for stirring the biological wasted sludge, and a heater for heating the biological wasted sludge.

13. The apparatus as defined in claim 12, wherein the biological  
15 wasted sludge is heated by the heater at a temperature ranging from 50 to 100°C.

14. The apparatus as defined in claim 11, wherein said  
neutralization reactor is provided with an agitator for stirring the  
20 hydrolyzed sludge, and a pH controller for regulating pH value of the intermediate feed.

15. The apparatus as defined in claim 14, wherein the pH  
controller is used to regulate the pH value of the intermediate feed such  
25 that the pH value of the intermediate feed is greater than 3 or smaller than 9.

16. The apparatus as defined in claim 13, wherein said neutralization reactor is provided with an agitator for stirring the hydrolyzed sludge, and a heat exchanger for lowering temperature of the hydrolyzed sludge.

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17. The apparatus as defined in claim 1, wherein the biological wasted sludge is obtained from the biological treatment unit of a wastewater treatment plant whereby the biological wasted sludge has a VSS/SS ratio ranging from 0.5 to 0.9, with VSS standing for volatile  
10 suspended solids, and with SS standing for total sludge concentration.